Measuring Microscopes
Hyper MF / MF-U

CATALOG No. E4267-176

Mitutoyo

Measuring Microscopes So Accurate They Defy Common Sense

Concept

Inspecting complex microstructures of ever-decreasing size demands ever-higher accuracy from measuring microscopes used to satisfy the manufacturing and quality control principle of 'Observation plus Measurement'. Mitutoyo is committed to providing microscopes that meet this requirement as well as exceeding users' expectations in terms of sophisticated functionality and ergonomic features that allow fatigue-free use over extended periods of time.

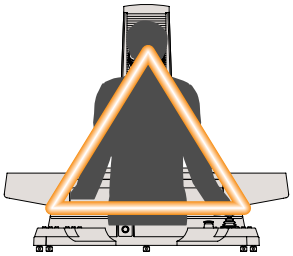
Mitutoyo

Core Technology

Over many years Mitutoyo has made significant contributions to the technologies that are key to the core technology of manufacturing industry: measurement. The experience and expertise gained is reflected in the design and manufacture of each individual component of these microscopes and can be seen most clearly in their sublime integration of optics, mechanics, and electronics.

Ergonomic Design

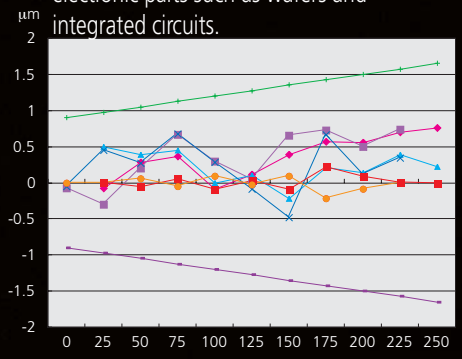
The microscope main unit has been designed with the emphasis on user friendliness and ease of operation. Mitutoyo has executed the mechanical design to allow easy operation. Even after extended use, its fatigue-fighting design still provides a comfortable work-experience for the operator.



World's Highest Measuring Accuracy

World's Highest Measuring Accuracy*

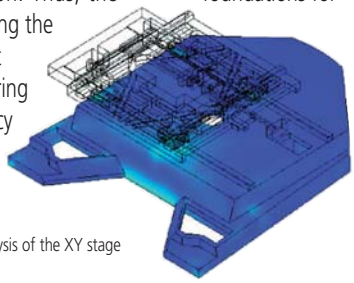
Measuring accuracy in the X- and Y-axes at full stroke surpasses class 0 of the JIS Standard for measuring microscopes (B7153-1995). This makes these microscopes ideal for high accuracy measurement of precision molds or cutting tools that require the best resolution, or for inspecting sub-miniature semiconductor/ electronic parts such as wafers and integrated circuits.



*As of April, 2004

Large, Highly Accurate XY Stage

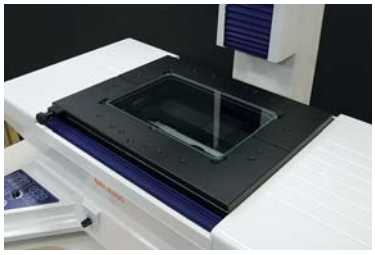
Mitutoyo uses a type of linear guideway on the large XY stage that is highly regarded for excellent straightness and stability. This is one key element in the strategy to maximize geometrical accuracy - another is FEM analysis. Our designers used FEM techniques extensively during the design phase to ensure stage stability was optimal in any measurement situation. Thus, the foundations for achieving the highest measuring accuracy were laid.



FEM analysis of the XY stage

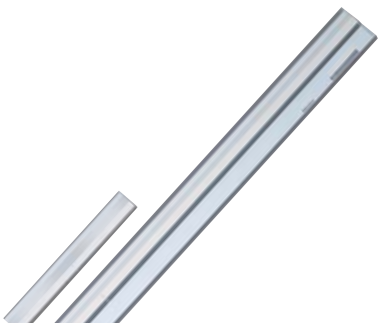
More about the XY Stage

The XY stage is a massive, highly stable design created using mechanical techniques developed over Mitutoyo's long years of experience in manufacturing precision measuring microscopes. Maximum stage loading is 30kgf (66lbf) and a range of useful fixtures is available that includes a wafer holder and swivel-center support.

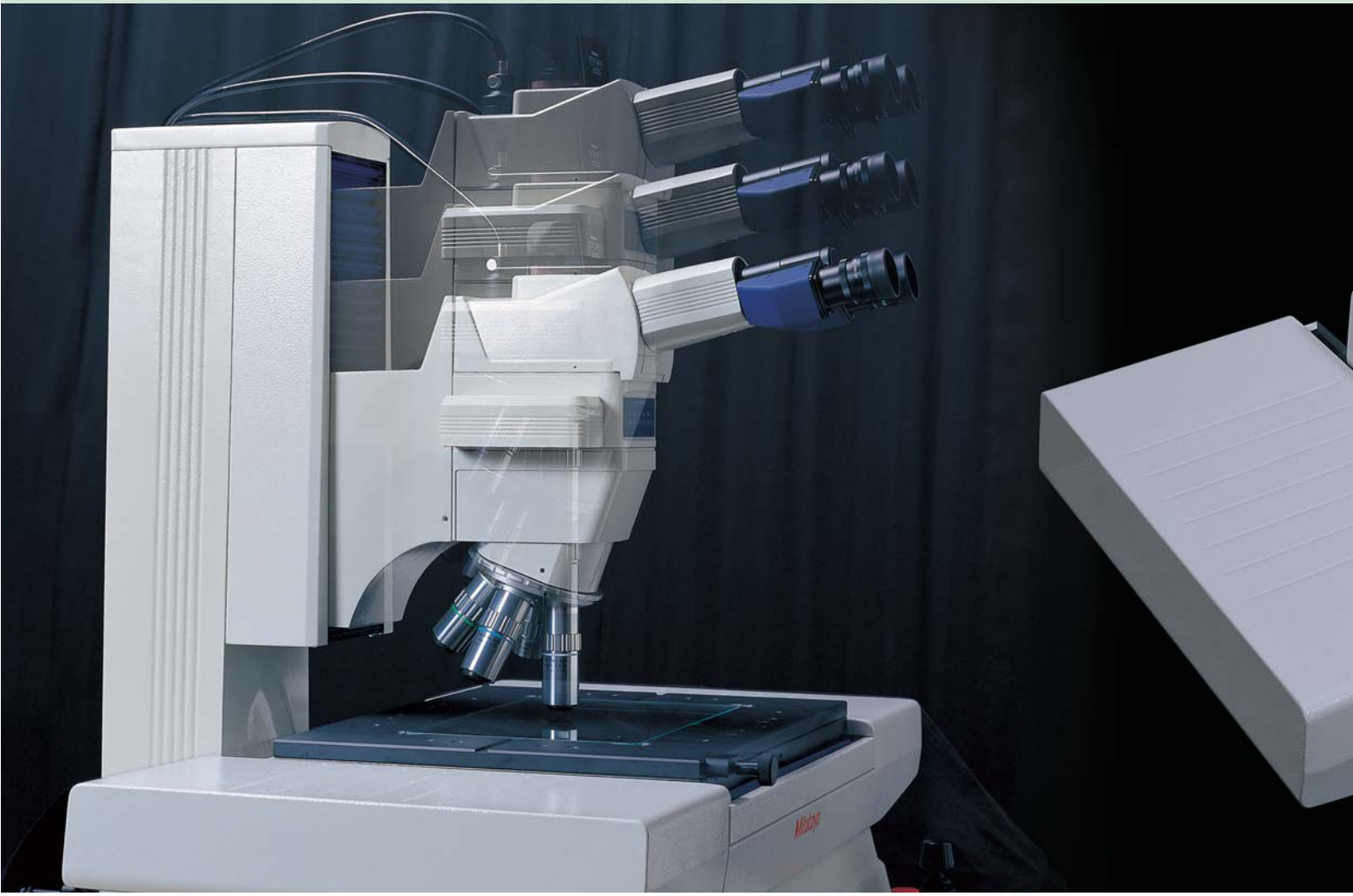


Highly Accurate Digital Scales

These microscopes are equipped with highly accurate digital glass scales on all three axes. Mitutoyo produces glass scales in an underground laboratory where the temperature and humidity are constant throughout the year. The XY (stage) and Z (optical tube) displacements are displayed digitally.

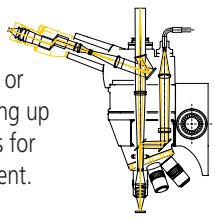


Excellent Operability and Solid Reliability



FS Optical System

The FS optical system is respected more than ever before for its ability to enable measurement, observation and analysis with a leading-edge combination of long working distance and high NA. This optical system ensures high operability when measuring deep holes, steps, etc., or when setting up workpieces for measurement.



Tilting Optical Tube*

To reduce fatigue due to extended use, it is important that the operator use a microscope in an unforced posture. The eyepiece unit allows stepless adjustment of tilt angle so that, no matter what their physique, operators can always adjust the viewing position for comfortable working during any measuring task.

* Available for model MF-U only.

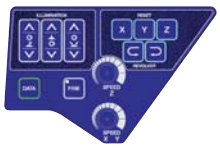
LAF Optical Tube*

The LAF (Laser AF) optical tube can be selected as an option. The LAF system achieves high repeatability when measuring minute steps, etc., enabling difficult measurements with minimum fatigue.

* Available for model MF-U only

Front Operation

Controls are arranged to fall within easy reach of the operator on two control panels at the front of the microscope. This allows the operator to concentrate on measurement without having to look away from the eyepieces. Membrane technology makes the switches very durable.



Left control panel

Right control panel

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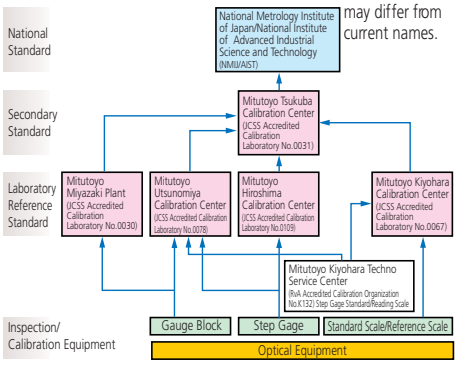
Measuring with Hyper MF - an Emotional Experience

Traceability to National Standards

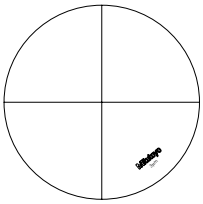
Mitutoyo intends to enhance international calibration services by collaboration with laboratories that have received the accreditation of ISO/IEC 17025 (ISO/IEC Guide 25) from JCSS and RvA NKO (Nederlandse Kalibratie Organisatie). Additionally, ISO9000 accredited Mitutoyo production plants and service divisions supply high-quality products and services.

* Organizational names are those at the time of accreditation and may differ from current names.


National Standard
National Metrology Institute of Japan/National Institute of Advanced Industrial Science and Technology (NMIJ/AIST)
Secondary Standard
Mitutoyo Tsukuba Calibration Center (JCSS Accredited Calibration Laboratory No.0031)
Laboratory Reference Standard
Mitutoyo Miyazaki Plant (JCSS Accredited Calibration Laboratory No.0030)
Mitutoyo Utsunomiya Calibration Center (JCSS Accredited Calibration Laboratory No.0078)
Mitutoyo Hiroshima Calibration Center (JCSS Accredited Calibration Laboratory No.0109)
Mitutoyo Kiyohara Calibration Center (JCSS Accredited Calibration Laboratory No.0067)
Mitutoyo Kiyohara Techno Service Center (RvA Accredited Calibration Organization No.K 132) Step Gage Standard/Reading Scale
Inspection/ Calibration Equipment
Gauge Block
Step Gage
Standard Scale/Reference Scale
Optical Equipment

Cross-hair Reticle

How accurately the reticle can be aligned with a workpiece feature is a very important feature in a measuring microscope. Taking ocular resolution into account, the thin-line reticle has been standardized on a broken, 90° cross hair with a line width of 5μm*. This allows precise positioning of the reticle.



* Cross-hair reticles of 3μm and 7μm line width are also available.

Fiber-optic Cold Light Illumination

A fiber-optic cold light illuminator and an IR absorption filter greatly reduce thermal effects on the instrument and workpiece that would otherwise have an adverse effect on measuring accuracy. Telecentric illumination is used for reflected light observation and Koehler illumination for viewing contours. Both systems use an aperture diaphragm for even, glare-free illumination with good image contrast.

System Extensibility

A video port is standard on the optical tube, thereby allowing a digital camera unit and various vision analysis units to be added to a system.

Digital Color Vision System DV-520
(Microscope main unit: MF-UA1010TH)

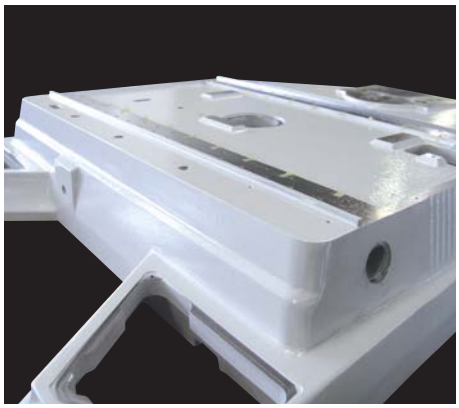
Main Specifications

Highest-in-Class Measuring Accuracy

MF/MF-U

Mitutoyo has achieved a measuring accuracy of ± (0.9 + 3L/1000)μm (L: Measured length in mm) in both X- and Y-axes. This performance surpasses Class 0* of JIS B7153:1995, Measuring Microscopes, and allows support of ultra-precise inspection and measurement of the smallest visible features to those extending across the full measuring range of these microscopes.

* Class 0: (2 + 0.01L) μm or less, L: Measured length (mm)



Three-axis Motor-driven Joystick Ensures High Operability from High Speed to Ultra-Low speed

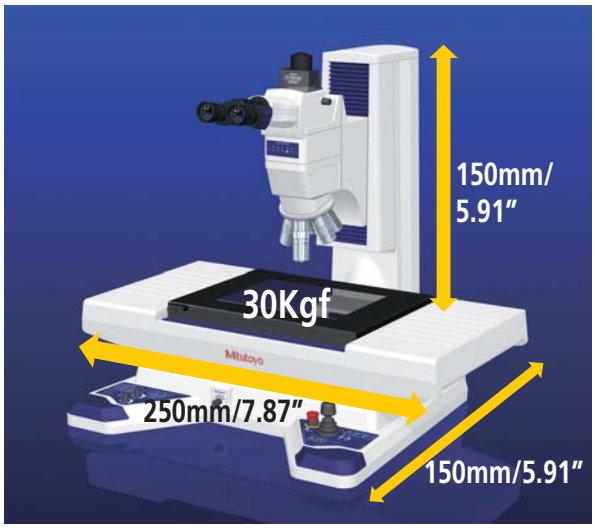
MF/MF-U

The X, Y, and Z axes are driven and controlled with one joystick that serves as the nerve center of front operation. Speed control is possible from high-speed traverse of the stage to ultra low-speed, minute positioning of a workpiece. Also, the lock mechanism is provided for each X, Y, and Z axis to support high-accuracy pitch measurement by single-axis displacement. The primary target is assumed to concentrate the operator on a workpiece.

Large, Highly Accurate XY Stage Handles Wide-field, Heavyweight Workpieces

MF/MF-U

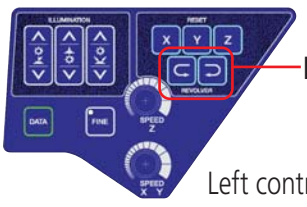
The pressures for diversification and upsizing of workpieces are increasing in various industrial fields, such as semiconductors, electronics, precision automotive parts and tools. These microscopes not only have the accuracy for the smallest workpiece but also have the power to handle larger components such as lead frames, precision cutting tools and molds.



Remote-controlled Objective Magnification Change

MF-U

The power turret in the optical tube is controlled with membrane switches on the left front panel. LEDs indicating each lens position on the upper part of the optical tube are linked to rotation of the turret so that the operator can see the current magnification at a glance.



Left control panel

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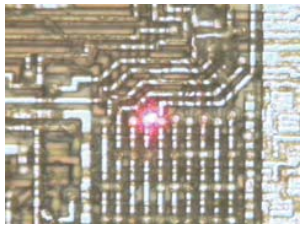
Laser Auto Focus

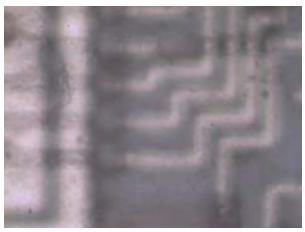
LAF Optical Tube

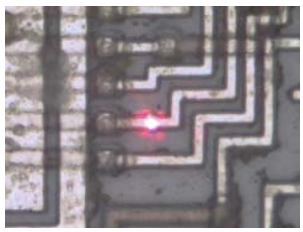
The laser auto focus function provides high accuracy and high repeatability and brings significant advantage to the inspection of minute steps, multi-layer board detail, etc. A powerful function that helps avoid operator error and ensures high productivity.

LAF is available both in BF and BD optical tubes.



MPlanApo 50 X





MPlanApo 100 X

LAF Effective in the Smallest Area

An LAF spot diameter of ø1μm or less is achieved using an objective with a magnification of 50X or more. This performance supports a wide range of measurement tasks.

The spot diameters are a logical value determined by calculation.

Objective	Spot diameter
MplanApo	2X 16μm/630μinch
MplanApo	5X 6μm/240μinch
MplanApo	10X 3μm/120μinch
MplanApo	20X 1.5μm/60μinch
MplanApo	50X 0.8μm/3μinch
MplanApo	100X 0.6μm/2μinch

Selectable LAF Functions

Providing a choice of the Just Focus (JF) mode that functions quickly at the current point of interest and the Tracking Focus (TF) mode that tracks the focusing position to retain sharp focus as the stage moves has improved measurement efficiency.

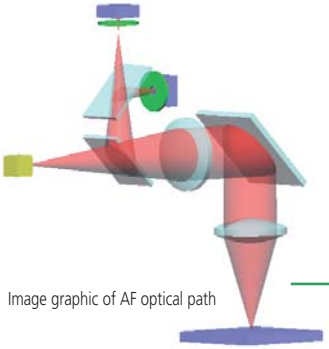


Image graphic of AF optical path

Visible Semiconductor Laser 690nm

The AF function delivers highly repeatable focusing on areas with different surface textures and slopes.

Laser Beam Class

The LAF (factory-fit option) function uses a low-power laser that corresponds to Class 2 (visible light) of JIS C6802/1997, Safety of Laser Products.

Main Unit Specifications

Hyper MF

Hyper MF-U

Model name			HyperMF	HyperMF-U
No.			176-401	176-402
Optical tube			-	(Bright field/bright field LAF/bright and dark field / bright and dark field LAF)*1
	Standard reticle (built-in)		90° broken cross-hair (line width: 5µm) Note: Not selectable for HyperMF-U	
	Pupil distance adjustment		Siedentopf type Adjustment range: 51 to 76mm/ 2.01" to 2.99"	
	Optical path transfer ratio		Observation/video camera = 50/50	
	Angle from horizontal		25°	Manual tilting
	Video port		Standard equipment	
Observation image			Erect image	
Eyepiece	Magnification		10X, 15X, 20X	
			Monocular unit (with one eyepiece) or binocular unit (with two eyepieces) selectable	Provided with two 10X eyepieces
Objective (option)	ML objective		1X, 3X (standard accessories), 5X, 10X, 20X, 50X, 100X	-
	Bright field (BF)		-	M Plan Apo, M Plan Apo SL, G plan Apo
	Bright/dark field (BD)		-	BD Plan Apo, BD Plan Apo SL
Turred	Bright field (BF)		-	(Centering, parfocal, manual control, 4-way/manual control, 4-way with sensor/centering, motor-driven control, 5-way with sensor*2)
	Bright/dark field (BD)		-	((Manual control, 4-way/manual control, 4-way with sensor/ motor-driven, 4-way with sensor*3)
Focusing unit	Maximum workpiece height		150mm/ 5.91"	
	Measuring accuracy*4		± (1.5+10L/1000) µm L: Measured length in mm	
	Drive method		Motor-driven control with the joystick	
Illumination	Contour illumination		Koehler illumination, aperture diaphragm built-in, 12V 50W halogen bulb, 100-step light adjustment, fiber-optic cold light illumination	
	Surface illumination		Telecentric illumination, variable aperture diaphragm mechanism, 12V 100W halogen bulb, 100-step light adjustment, fiber-optic cold light illumination	
Stage	Measuring range (X-axis x Y-axis)		250mmX150mm/ 9.84"X5.91"	
	Measuring accuracy*5 (at no load on X- and Y-axis)		± (0.9+3L/1000) µm L: Measured length in mm	
	Top face dimensions		460mmX350mm/ 18.11"X13.78"	
	Effective dimensions of stage glass		300mmX200mm/ 11.81"X7.87"	
	Swivel range		±3°	
	Maximum loading		30kgf/ 66lbf	
	Drive method		Motor-driven control with the joystick	
Detector unit			High-accuracy digital scale (Patent registered)	
Digital display	Resolution		0.01µm/ .0004µinch	
	Display axes		X, Y, and Z axes	
	Data processing unit		QM-DATA200 or Vision Unit	
Control unit	Joystick lock		○	
	Fine pitch		○	
	Data output		○	
	Digital display reset		○	
	Illumination brightness controller		○	
	LAF (Just focus)		-	○ (with LAF installed)
	LAF (Tracking focus)		-	○ (with LAF installed)
	Turret remote-control		-	○ (with the power turret installed)
External dimensions	Microscope main unit (WXDXH)		880mmX913mmX730mm/ 34.65"X35.94"X28.74"	880mmX913mmX770mm/ 34.65"X35.94"X30.31"
	Power unit		160mmX476mmX381mm/ 6.30"X18.74"X15"	
Mass	Microscope main unit		Approx. 250kg/ 551.2lb	Approx. 255kg/ 562.2lb
	Power unit		14kg/ 30.86lb	
Power supply			100, 110, 120, 220, 230, 240VAC 50/60Hz Maximum power consumption 700W	

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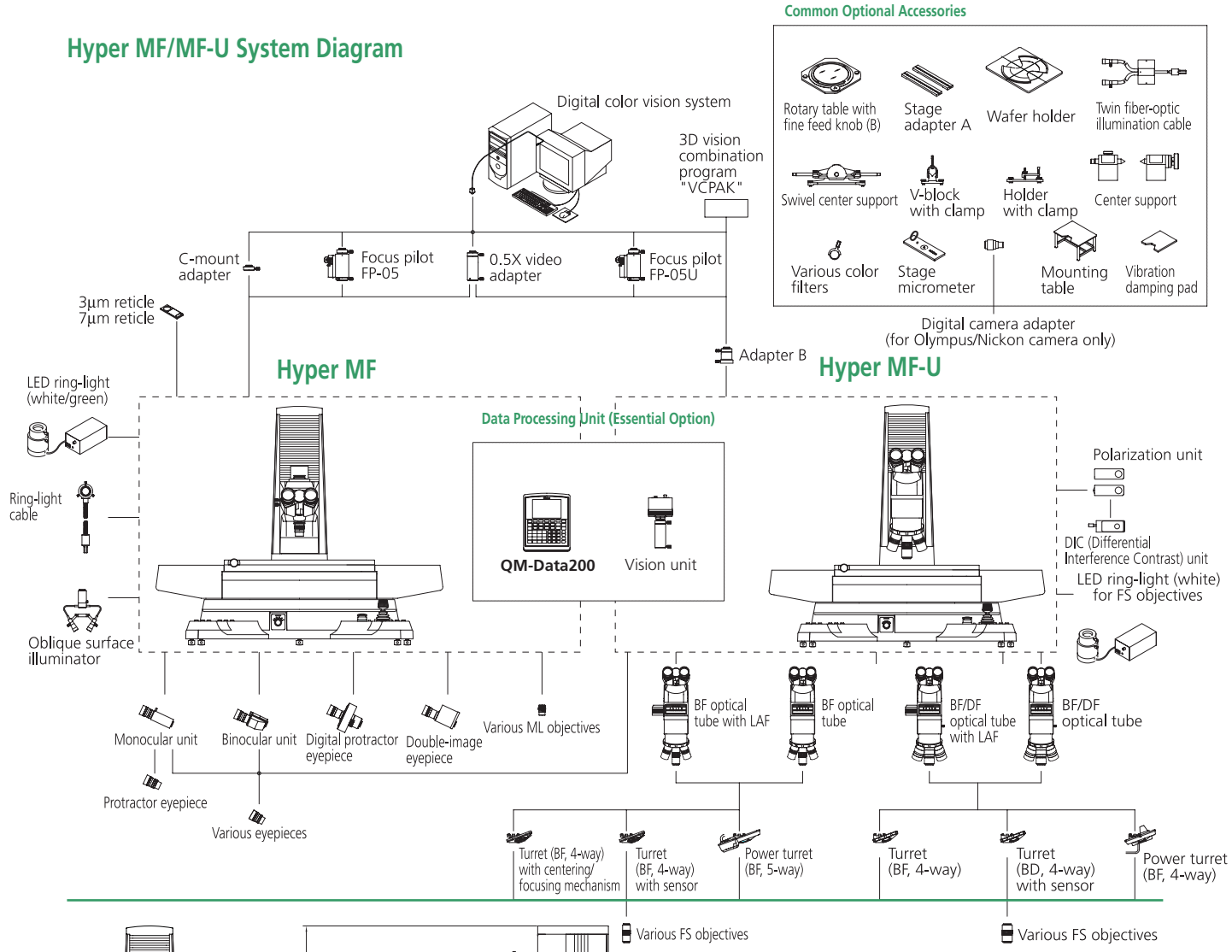
*1, 2, 3: Factory-fit option

*4, 5: The measuring accuracy conforms to JIS B 7153.

Upon bulb replacement, order the contour illumination halogen bulb 12V 50W (No.02APA527) or surface illumination halogen bulb 12V 100W (No.517181). The high-brightness specification bulb (No.12BAD602) is also available as a 12V 100W bulb.

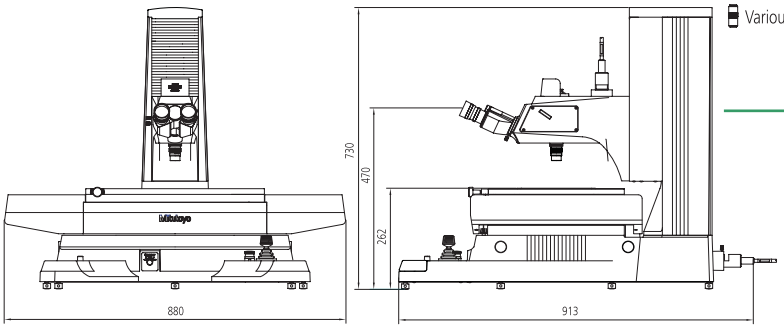
System Configuration

Hyper MF/MF-U System Diagram

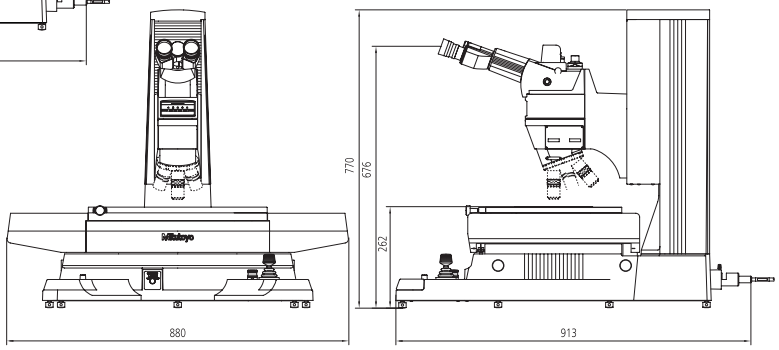


Dimensions

Hyper MF



Hyper MF-U



Data Processing System
2D Calculating System

QM-Data 200 System

Features

- Powerful 2D measurement capabilities with graphic display functions that make the most of the large LCD screen
- Graphical help on the screen guides the operator during measurement sequences.
- Measurement results are displayed automatically
- Measurement procedures (Part Programs) can be learnt by the system and easily repeated with position navigation help on screen
- Frequently-used combination measurements (e.g. circle-to-circle) are single-key operations
- The Automatic Identification (AI) function recognizes the feature type automatically, making preselection unnecessary
- Macros to initiate learned measuring sequences can be created at a keystroke
- Custom menus to suit specific requirements can be created
- Tolerance comparisons and various statistical evaluation options are possible for every measurement result.
- Measurement results can be output to MS Excel* in table form (CSV)
- Measurement results and Part Programs can be stored on the floppy-disk drive available as an optional accessory
- A free-standing table version with tilting device is available
- The next measurement can be started even while the last is printing out

* MS-Excel is a registered trademark of Microsoft Corporation.

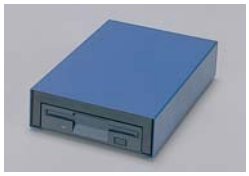
Specifications

Order No.	264-140 (Free-standing operation)
Display languages	Japanese, English, German, Italian, Spanish, Portuguese, Chinese, and Korean
Measurement value unit	Length: mm, angle: degree/degree, minute, second (selectable)
Resolution	0.1μm
Programming function	Create/run/edit measuring procedures
Statistical processing	Measurement item, quantity of data, maximum value, minimum value, mean, standard deviation, range, histogram
Number of elements in memory	Maximum 1000 elements
Element call	Point, line, circle, distance, ellipse, square hole, slotted hole, point and angle of intersection
Element key-in	Point element, line element, circle element
Display unit	Monochrome graphic LCD (320 x 240 dots, backlighted)
Input connector	(1) RS-232C [2]: Connected to the counter on the main unit. (2) X, Y, Z: Linear scale input (for the types with no counter) (3) OPTOEYE: OPTOEYE edge signal (for connecting OPTOEYE M2) Note: Available only if linear scale input is used. (4) FS:Connected to the foot switch.
Output connector	(1) RS-232C [1]: Connected to an external PC (measurement results) (2) PRINTER: Connected to the printer/external printer (measurement results) (3) FD: Connected to the FDD unit (measurement result file, measuring procedure file)
Measurement result file output	RS-232C output (CSV format, MUX-10 format)
Power supply	100 to 240VAC, 50/ 60Hz (AC adapter used)
Maximum power consumption	24W (excluding optional accessories)
External dimensions	approx. 260 x 242 x 310 mm (including the stand) / 10.24" x 9.53" x 12.20"
Mass	approx. 2.2kg/ 4.85lbs

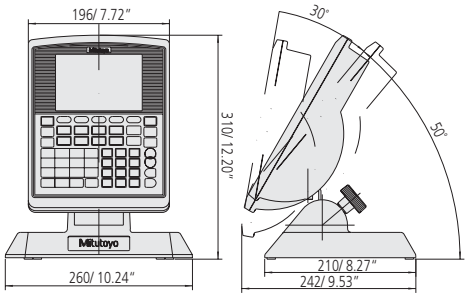
FDD Unit

Order No. 12AAA799

- Used for saving/reading files of part programs, user macros, measurement results, etc.



Dimensions



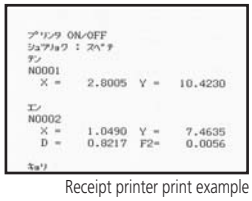
Printer

Order No. 12AAD032

- Used to print measurement results.

[Optional accessories]
Order No.908353
Printer paper (5 rolls)

* An external printer (color/monochrome) compatible with ESC/P is also available.
Printer control code system: ESC/P, compatible with MS-DOS.
Pin-out: 24 pins
ESC/P printer cable: 2m
(Order No.12AAA804)- - - Option



Receipt printer print example

Print method	Serial-matrix thermosensitive method
Number of print digits	40 digits
Print speed	Maximum 52.5cps (normal character)
External dimensions (WxDxH)	160x170x65.5 mm (printer main unit) / 6.30"x6.69"x2.58"
Standard accessories	Printer cable, printer paper (1 roll), AC adapter (for 100V)

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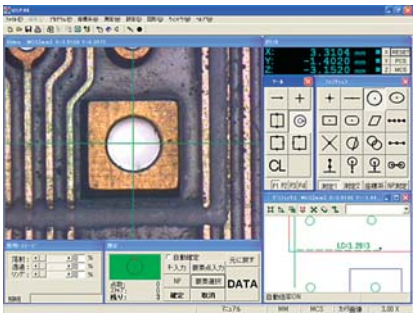
Vision Unit System

Features

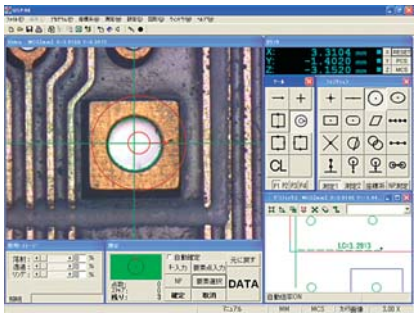
• Automatic edge detection tool and measurement macro icons enable single-key measurement
• Graphics and measurement navigation function support ease of use
• Image capturing/saving function
• Tolerancing calculation results and statistical processing for each item
• Measurement results can be exported to MS-Excel* in CSV format (allows unique inspection sheets to be created on the same PC)
• Supports total measurement on a single screen.
• Automatic light equalizing function faithfully reproduces illumination conditions

* MS-Excel is a registered trademark of Microsoft Corporation.

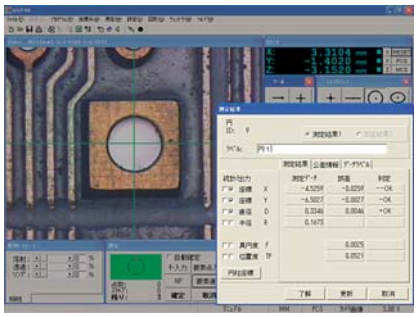
Measuring a Workpiece Feature



1) Display the feature to be measured on the monitor, adjust the illumination and focus with the microscope main unit, and then select the feature and the edge detection tool.



(2) Click in the vicinity of the feature with the mouse to automatically detect its edge and perform the measurement/calculation.



(3) The measurement results for the feature selected are displayed on the monitor.

Specifications

Order No.		359-680
Optical system		0.5X (0.5X video adapter built-in) when Mitutoyo measuring microscope is installed
Image detecting unit		High-sensitive 1/3" CCD colour camera
External dimensions of CCD camera		100X58X89mm/ 3.94"X2.28"X3.50"
Mass of CCD camera		0.4kg/.88lb
Monitor magnification/monitor visual field (at the use of 3X lens)		Approx. 63 X /3.1 X 2.3mm/ 2.48" X /.12" X .09" when Mitutoyo measuring microscope is installed
Resolution		0.01μm/ .4μinch
Measuring accuracy		Depends on the accuracy of the measuring microscope.
PC	CPU	Pentium 4 2.26GHz 256MB memory
	Display	15 inch LCD
	OS	MS-Windows XP*
	Software	QSPAK
	Maximum power consumption	Max. 400W

* MS-Windows XP and MS-Excel are registered trademarks of Microsoft Corporation. The PC configuration and specifications are subject to change without notice.

Lens and Illumination

Eyepieces

Monocular unit MF

No.176-302
With one eyepiece 10 x /24

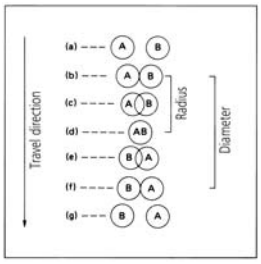
Binocular unit MF

No.176-303-1
With two eyepieces 10 x /24

Eyepiece MF/MF-U

Part name	WF10 x /24	WF15 x /16	WF20 x /12
No.(1-piece pack)	378-856-5	378-857-5	378-858-5
No.(2-piece pack)	378-856	378-857	378-858
Magnification	10 x	15 x	20 x
Field number	24	16	12

Double-image eyepiece MF



No.375-044
Aids accurate measurement of hole-to-hole distances, hole diameters and sections using the double image generated when the feature under inspection is not aligned with the optical axis of the microscope.
• Magnification: 10X
• Field number: 22

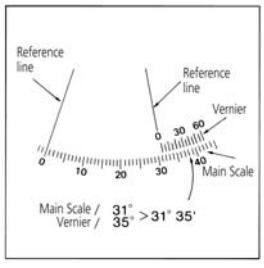
Rotary template eyepiece MF

No.176-357
Uses a template to superimpose screw thread forms (metric UST, Unified Screw Thread), concentric circles, and crosshairs on the workpiece image for quick and efficient measurement by comparison.
• Magnification: 10X • Field number: 21

ISO metric screw pitch (for 3X objective)	0.25, 0.3, 0.35, 0.4, 0.45, 0.5, 0.6, 0.7, 0.75, 0.8, 0.9, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4
ISO unified screw thread/ inch (for 3X objective)	80, 75, 64, 56, 48, 44, 40, 36, 32, 28, 24, 20, 18, 16, 14, 13, 12, 11, 10, 9, 8, 7, 6
Concentric circles with cross hairs (for 3X objective)	ø1, ø2, ø3, ø4, ø5
Dotted-line cross scale	60˚, 90˚

Protractor eyepiece MF

No.375-043
Measures angles between workpiece edges by successive alignment with two crosshairs whose separation is adjustable and calibrated through 360°.
• Magnification: 10X
• Field number: 21
• Resolution: 5′



Digital protractor eyepiece MF

No.375-040
Measures angles between workpiece edges by successive alignment with reticle crosshairs whose rotation is digitally calibrated. Switching or resetting the resolution is controlled with the standard accessory counter. Data output to an RS-232C equipped PC is possible.
• Magnification: 10X • Field number: 18 • Reticle: 90° solid line, 45° broken line • Angular resolution: 0.00° or 1'
• Power supply: 9VAC, 500mA • Maximum power consumption: 4W • Maximum angle value: ±369.99° or ±369°59'

Mitutoyo

Objective

ML objective MF

Model name	ML1X	ML3X	ML5X	ML10X	ML20X	ML50X	ML100X
No.	375-036	375-037	375-034	375-035	375-051	375-052	375-053
Magnification	1 X	3 X	5 X	10 X	20 X	50 X	100 X
Numerical aperture N.A.	0.03	0.07	0.11	0.18	0.42	0.55	0.7
Working distance WD	59mm/ 2.32"	72.5mm/ 2.85"	59.5mm/ 2.34"	44mm/ 1.93"	20mm/ .99"	13mm/.51"	6mm/ .24"
Focal depth	306µm/12.05µinch	56µm/ 2.20µinch	23µm/ .91µinch	8µm/ .31µinch	1.6µm/ .06µinch	0.9µm/ .04µinch	0.6µm/ .02µinch

FS objective Bright field (BF) MF-U

Model name	MplanApo1X	MplanApo2X	MplanApo5X	MplanApo10X	MplanApo20X	MplanApo50X	MplanApoHR50X	MplanApo100X	MplanApoHR100X
No.	378-800	378-801	378-802-2	378-803-2	378-804-2	378-805-2	378-814	378-806-2	375-815
Magnification	1 X	2 X	3 X	10 X	20 X	50 X	50 X	100 X	100 X
Numerical aperture N.A.	0.025	0.055	0.14	0.28	0.42	0.55	0.75	0.7	0.9
Working distance WD	11mm/.43"	34mm/ 1.33"	34mm/ 1.34"	33.5mm/ 1.32"	20mm/ .79"	13mm/ .51"	5.2mm/ .20"	6mm/ .24"	1.3mm/ .05"
Focal depth	440µm/17.32µinch	91µm/ 3.58µinch	14µm/ .55µinch	3.5µm/ .14µinch	1.6µm/ .06µinch	0.9µm/ .04µinch	0.48µm/ .02µinch	0.6µm/ .02µinch	0.34µm/ .01µinch

Model name	MplanApoSL20X	MplanApoSL50X	MplanApoSL80X	MplanApoSL100X	MplanApoSL200X	GplanApo20X(t3.5)	GplanApo50X(t3.5)
No.	378-810-2	378-811-2	378-812-2	378-813	378-816	378-847	378-848
Magnification	20 X	50 X	80 X	100 X	200 X	20 X	50 X
Numerical aperture N.A.	0.28	0.42	0.5	0.55	0.62	0.28	0.5
Working distance WD	30.5mm/ 1.20"	20.5mm/ .81"	15mm/ .59"	13mm/ .51"	13mm/ .51"	29.42mm/ 1.16"	13.89mm/ .55"
Focal depth	3.5µm/ .14µinch	1.6µm/ .09µinch	1.1µm/ .04µinch	0.9µm/ .04µinch	0.7µm/ .03µinch	3.5µm/ .14µinch	1.1µm/ .04µinch

FS objective Bright/dark field (BD) MF-U

Model name	BDplanApo2X	BDplanApo5X	BDplanApo10X	BDplanApo20X	BDplanApo50X	BDplanApoHR50X	BDplanApo100X	BDplanApoHR100X
No.	378-831	378-832	378-833	378-834	378-835	378-845	378-836	378-846
Magnification	2 X	5 X	10 X	20 X	50 X	50 X	100 X	100 X
Numerical aperture N.A.	0.055	0.14	0.28	0.42	0.55	0.75	0.7	0.9
Working distance WD	34mm/ 1.34"	34mm/ 1.34"	33.5mm/ 1.32"	20mm/ .79"	13mm/ .51"	5.2mm/ .20"	6mm/ .24"	1.3mm/ .05"
Focal depth	91µm/ 3.58µinch	14µm/ .55µinch	3.5µm/ .14µinch	1.6µm/ .06µinch	0.9µm/ .04µinch	0.48µm/ .03µinch	0.6µm/ 02µinch	0.34µm/ .01µinch

Model name	BDplanApoSL20X	BDplanApoSL50X	BDplanApoSL80X	BDplanApoSL100X
No.	378-840	378-841	378-842	378-843
Magnification	20 X	50 X	80 X	100 X
Numerical aperture N.A.	0.28	0.42	0.5	0.55
Working distance WD	30.5mm/ 1.20"	20mm/ .79"	13mm/ .51"	13mm/ .51"
Focal depth	3.5µm/ .14µinch	1.6µm/ .06µinch	1.1µm/ .04µinch	0.9µm/ .04µinch

Illumination

Oblique surface illuminator MF

No.172-351

This uses the surface illumination light source in the microscope main unit. The light equalizing function and condenser lens are included. 12V 100W

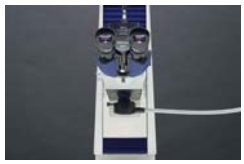
* 10X lens or less is applicable.

Twin fiber-optic illuminator MF/MF-U

No.176-416

This uses the surface illumination light source in the microscope main unit. The light equalizing function and condenser lens are included. 12V 100W

Fiber-optic ring-light MF



No.176-417

This uses the surface illumination light source in the microscope main unit. The light equalizing function and condenser lens are included. 12V 100W

* 10X lens or less is applicable.

LED ring-light MF

No.176-367 (White LED)
No.176-368 (Green LED)

Position is adjustable so as to be appropriate for the light equalizing function and working distance. 12V 7.7W, outside diameter: 70mm/2.76".

* 10X lens or less is applicable.

LED ring-light (for FS Objectives) MF-U

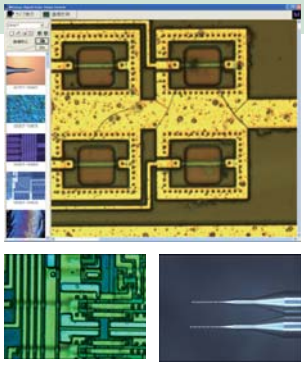
No.78829 (White LED)

Position is adjustable so as to be appropriate for the light equalizing function and working distance. 12V 7.7W, outside diameter: 70mm/ 2.76".

* 10X lens or less is applicable.

Main Optional Accessories

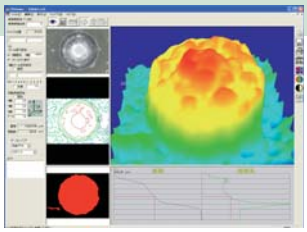
Digital Color Vision



C-mount compatible high-definition digital color vision system. Allows anyone to easily capture and save high quality images from the microscope. Three types: 5.2Mpixel, 2.1Mpixel, and 0.5Mpixel.

•Main functions
Image filing, on-screen manual measurement, white balance, comments on an image, scale display, etc.
No.176-380: DV-50CL (LCD spec)
No.176-384: DV-210L (LCD spec)
No.176-382: DV-520L (LCD spec)
* On-screen manual measurement requires the calibration chart (No.02AKN020) separately.

3D Vision Combination Program VCPAK



This system is based on an omnifocal image focused in the whole visual field of the microscope to greatly improve observation at small depths of focus. It also enables 3D vision display.

•Main functions
High-quality digital imaging, real-time vision combination, combination by capturing a maximum of 256 sheets of images, adoption of universal image file formats (JPEG, BMP, TIFF, DIB), thumbnail display of saved images, noise reduction function, etc.

Polarization Unit

No.378-092
Bright field (BF)
Bright and dark field (BD)

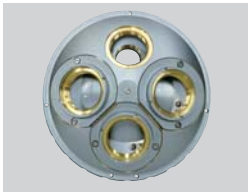
DIC Unit

No.378-080: For 5X, 10X
No.378-079: For 20X
No.378-078: For 50X, SL20X
No.378-076: For 100X, SL80X, SL50X

Illumination Filter

No.12AAA643:ND2
No.12AAA644:ND8
No.12AAA645:GIF
No.12AAA646:LB80

Centering, Parfocal Turret



No.378-018
Objectives: Up to 4 Visual field adjustment range: ±0.5mm / .02"
Parfocal adjustment range: ±0.5mm / .02"

Power Turret (for BF)

No.176-411
Ojectives: Up to 5
Visual field adjustment range: ±0.5mm/.02"
Positioning accuracy: 2σ=3μm/120μinch
Drive life: 1,000,000 movements

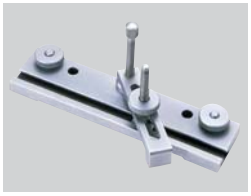
V Block with Clamp

No.172-378
Maximum clamp diameter: ø25mm/.98"
Mass: 0.8kg/ 1.76lb
* Stage Adapter A is used together.

Swivel Center Support

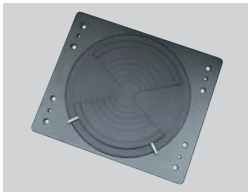
A tilt angle of ±10° can be supported.
Minimum reading of angle: 1°
Maximum support size: ø80 x 140mm/ 3.15" x 5.51" in horizontal orientation
ø65x140mm/ 2.56"x5.52" at a tilt angle of 10°
Mass: 2.5kg/ 5.51lb
* Stage Adapter A is required.

Holder with Clamp



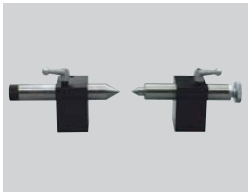
No.176-107
Maximum workpiece thickness: 35mm/ 1.38"
Mass: 0.4kg/ .88lb
* Stage Adapter A is required.

Wafer Holder



No.176-414
Wafer size: 3 to 8 inches
Rotary Holder (No.378-363) attached
Mass: 3.2kg/ 7.06lb

Center Support

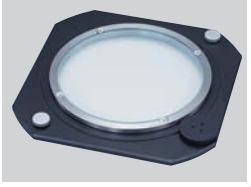


No.176-415
Maximum support length: 250mm/9.84"
Maximum support diameter: ø150mm/5.91"
Maximum diameter allowing external apex observation: ø140mm/ 5.51"
Effective stroke of the center-clamping mechanism: 22mm/ .87"
Mass: 13kg/ 28.66lb

Stage Adapter A

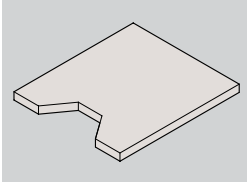
No.176-304
2 pieces pack Mass: 1.5kg/ 3.31lb

Rotary table with fine feed knob (B)



No.3176-306
Effective glass diameter: ø240mm/ 9.45"
Rotary table rotation angle: Approx. 51.5° (per full turn of the fine feed knob) Mass: 6.5kg/ 14.33lb

Vibration Damping Pad



No.176-419
Spring pad type
Float unit material: SUS304
WxDxH = 800x900x49mm/ 31.50"x35.43"x1.93"
Mass: 58kg/ 127.9lb

Machine Stand

No.176-418
Max. loading: 400kgf/ 881.8lbf
WxDxH = 1100x900x650mm/ 433.07"x35.43"x26.59"
Mass: 45kg/99.21lb

Mitutoyo

Measuring Microscope Line-up

Demand for measuring microscopes that can perform observational tasks as well as measurement is increasing rapidly in various sectors of industry such as semiconductors, electronic parts, precision auto parts and tools. The following summarizes Mitutoyo's line-up of measuring microscopes actively participating in many industries. Mitutoyo intends to widen the appeal of measuring microscopes that can determine miniscule part dimensions on a workpiece and make them serve as the Basic Machine for non-contact measurement.

High-accuracy Measuring Microscopes

Hyper MF/MF-U

Hyper MF

Hyper MF-U

Series name	HyperMF	HyperMF-U
Optical tube	Standard (finite distance compensation)	Metallurgical microscope (finite distance compensation)
Measuring range (X·Y·Z)	250·150·150mm	
Control system/ reading unit	3-axis motor-driven with Joystick/digital scale	
Resolution	0.01	
Data processing unit	QM-DATA200/vision unit	
Video port	Standard equipment	

Measuring Microscopes

MF-A/UA

MF-A

MF-UA

Series name	HyperMF	MF-A/UA
Optical tube	Standard (finite distance compensation)	Metallurgical microscope (finite distance compensation)
Measuring range (X·Y·Z)	50·50·150/100·100·150/200·100·150/ 200·170·220/300·170·220mm	
Control system/ reading unit	Manual/digital scale	
Resolution	0.1/0.5/1μm	
Data processing unit	QM-DATA200/vision unit	
Video port	Standard equipment	

Toolmaker's Microscope

TM

TM-505R

Series name	TM
Optical tube	Standard (finite distance compensation)
Measuring range (X·Y·Z)	50·50·115/100·50·107mm
Control system/ reading unit	Manual/micrometer head
Resolution	1(MHD head)
Data processing unit	QM-DATA200
Video port	None

Note:
All our product details, in particular the illustrations, drawings, dimension and performance details and other technical specifications contained in this publication are to be considered to be approximate average values. To this extent, we reserve the right to make changes in design, technical data, dimensions and weight. Our specified standards, similar technical rules and technical specifications, descriptions and illustrations of the products are correct at the time of printing. The current version of our general terms and conditions also apply. Only offers which we have submitted can be considered to be definitive.

- Coordinate Measuring Machines
- Vision Measuring Systems
- Surface-, Form- and Contour Measurement
- Optical Measuring
- Sensor Systems
- Hardness Measuring
- Digital Scale and DRO Systems
- Small Tool Instruments and Data Management

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